

Boston Public Health Commission
Biological Laboratory Safety Permit Application

SECTION 3: BSL-4 CHEMICAL HYGIENE PLAN

Boston University
National Emerging Infectious Diseases Laboratories

November 2014

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1.0 INTRODUCTION

The U.S. Department of Labor Occupational Safety and Health Administration (OSHA) promulgated the Occupational Exposure to Hazardous Chemicals in Laboratories, [Title 29 Code of Federal Regulations \(CFR\) Part 1910.1450](#), on January 31, 1990. This regulation, known as the “Laboratory Standard,” applies to all laboratories that use hazardous chemicals. The regulation mandates that laboratories ensure protection for employees from the potential hazards of the chemicals they work with or may be exposed to. To meet this obligation, laboratories are required to develop a Chemical Hygiene Plan that provides employees with information on hazardous chemicals that may be present in the work area, and describes appropriate work practices, procedures, training requirements, and controls that are in place to protect employees from those hazards, including the proper use of personal protective equipment.

To meet the requirements of the regulations, Boston University (BU) and Boston Medical Center (BMC) Environmental Health & Safety (EHS) is charged with ensuring that all aspects of BU/BMC operations are conducted in a manner that minimizes the potential of harm to human health and the environment. This includes ensuring the health and safety of employees, faculty, students, patients, and other visitors, as well as protection of the environment within the institution and external to it. Oversight and monitoring of safety within the research laboratories at BU and BMC is the responsibility of the EHS Research Safety Division and includes the development and implementation of comprehensive biological, chemical, and laboratory safety and controlled substance programs.

The existing health and safety programs of BU/BMC administer all activities within the National Emerging Infectious Diseases Laboratories (NEIDL); the Research Safety Division provides oversight of the activities.

2.0 PURPOSE OF APPLICABILITY

This Biosafety Level 4 (BSL-4) Chemical Hygiene Plan (CHP) defines laboratory work practices, laboratory equipment, personal protective equipment, and procedures to help ensure that laboratory workers and those supporting laboratories at the Boston University NEIDL are protected from the hazards associated with the chemicals used in the laboratory work environment (see Appendix A). **The use of chemicals in the containment is reviewed by EHS with the PI. Any new chemical that is proposed to be used must first be reviewed by EHS to determine its compatibility to PPE, equipment and procedures currently employed in the laboratory.**

This CHP is also intended to meet the University's compliance with the requirements of a Chemical Hygiene Plan, as defined by the OSHA Laboratory Safety Standard. It applies to BSL-4 laboratories in the NEIDL that use or store hazardous chemicals and compliments the [Boston University Chemical Hygiene Plan](#)

According to the Laboratory Safety Standard, the CHP must include:

- Program guidelines for development of standard operating procedures;
- Criteria to determine and implement specific control measures, such as engineering controls and personal protective equipment;
- A requirement that an ongoing program be developed to ensure that engineering controls are functioning properly;
- Information and training requirements;
- Circumstances under which a particular laboratory function will require "prior approval";
- Provisions for medical consultation and medical exams;
- Designation of a Chemical Hygiene Officer;
- Additional precautions for work with select carcinogens, reproductive toxins, and extremely toxic substances.

EHS, in collaboration with the Laboratory Safety Committee and representatives of affected laboratories, developed this CHP to meet the needs of the BSL-4 laboratories within the NEIDL, which is located on the Boston University Medical Campus. This BSL-4 CHP describes in detail the policies, practices, procedures, equipment, and facilities that collectively ensure that all persons who work with chemicals do so in a safe manner and in compliance with all applicable federal, state, and local regulations and University guidelines.

Employees should direct questions about this CHP or the safe use of chemicals to their Laboratory Supervisor/Principal Investigator, the Laboratory Safety Committee (LSC), and/or EHS.

In addition to the LSC, several other committees have the authority to regulate certain aspects of work in laboratories. These committees may include the Radiation Safety Committee (RSC), the Institutional Biosafety Committee (IBC), the Laser Safety Subcommittee, and the Institutional

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Animal Care and Use Committee (IACUC). This document does not preempt any of the policies or procedures issued by these other committees. In cases where the jurisdictions of two committees overlap, the more stringent constraint applies.

This BSL-4 CHP must be available to all laboratory workers prior to the commencement of laboratory duties. In addition to the BSL-4 CHP, laboratory workers must be familiar with and adhere to all laboratory safety guidelines and procedures developed by their Laboratory Supervisor/Principal Investigator, EHS, and other University departments, and any federal, state, or local regulatory agencies.

This BSL-4 CHP will be reviewed annually by the LSC and EHS.

3.0 OVERVIEW OF ROLES AND RESPONSIBILITIES

The following are responsible for implementing the requirements of this CHP.

3.1 Associate Vice President for Research Compliance

The Associate Vice President for Research Compliance (AVP-RC) is responsible for oversight of the control of hazards in the research laboratories and for ensuring that comprehensive, enterprise-wide programs are in place for the safe handling of all hazardous materials (e.g., biological, chemical, radiological) and 2) all non-financial research compliance at BU/BMC. The AVP-RC has direct functional responsibility for the EHS and the Research Safety Division, the Institutional Biosafety Committee (IBC), the Charles River Institutional Review Board (IRB), laboratory safety committees, IACUC and laboratory animal use and care programs, the responsible conduct of research, and other research-related oversight committees.

The AVP-RC serves as the Responsible Official (RO) for all compliance functions associated with the City of Boston's Public Health Commission Biological Laboratory Regulation. The AVP-RC develops and ensures communication between the IBC, LSC, IRB, and IACUC and regulatory agencies (e.g., City of Boston, Centers for Disease Control and Prevention).

3.2 Laboratory Safety Committee

The Laboratory Safety Committee (LSC) is composed of members of the Boston University faculty and administrative departments that have laboratories working with or storing hazardous chemicals. The committee also includes members of EHS, Office of the Provost, Research Occupational Health Program, Facilities Management & Planning, and other University departments that support laboratories at the University.

The LSC meets on a quarterly basis. The duties of the committee include:

- Annual review of the BSL-4 CHP;
- Implementation of the BSL-4 CHP;

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- Review of standard operating procedures, as necessary;
- Review of written guidelines and training programs, as necessary;
- Discussion of laboratory safety issues and incidents;
- Development of policies/practices regarding laboratory safety issues.

3.3 Environmental Health & Safety

Environmental Health & Safety (EHS) responsibilities include the following:

- Design safety training programs;
- Conduct safety training programs that are not site-specific;
- Conduct site- or topic-specific trainings as requested or required;
- Conduct laboratory safety inspections on a routine basis and on request;
- Conduct periodic and requested inspections of engineering controls;
- Make recommendations for corrective actions in cases of non-compliance;
- Oversee the hazard assessment and development of lab-specific standard operating procedures, in consultation with LSC, as necessary;
- Investigate cases of suspected exposure or exposure due to accident;
- Provide chemical spill response in accordance with emergency response plans;
- Maintain laboratory safety training records and ensure, in collaboration with the PI, that all laboratory workers complete annual Laboratory Safety Training;
- Assist the PI and laboratory workers with compliance with this Plan;
- Maintain incident reports;
- Manage the hazardous waste program.

3.4 Chemical Hygiene Officer

The Chemical Hygiene Officer (CHO) is a staff member of Environmental Health & Safety. Responsibilities of the CHO include:

- Develop and implement appropriate laboratory safety policies, practices, and procedures in collaboration/consultation with the Lab Supervisor/PI and with the approval of the LSC, when appropriate;
- Ensure that the CHP is readily accessible to all employees, either as a paper copy, an electronic copy online, or another applicable means;
- Communicate to each Laboratory Supervisor/Principal Investigator any relevant safety information or concerns pertaining to his or her laboratory;
- Ensure that each PI is aware of the CHP.

3.5 Principal Investigator

The responsibility for ensuring that all work in Boston University laboratories is safe and in compliance rests with the Principal Investigator (PI) and EHS. The PI designation refers to the

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faculty member responsible for work in a specific laboratory facility. This person, in collaboration with EHS, must develop any laboratory-specific standard operating procedures to be followed in his or her laboratory. The PI can assign duties to a Laboratory Supervisor, but the PI is ultimately responsible for the safe and compliant conduct of work in his or her laboratory.

The PI's duties also include the following actions:

- Define the location of work areas where toxic substances, potential carcinogens, and other hazardous chemicals will be used;
- Ensure that an inventory of these and all other chemicals is provided to EHS, through utilization of the Chemical Inventory database in RIMS (Research Information Management System);
- Assist EHS and the CHO in defining all hazardous operations, alerting employees to the hazards, and establishing safe procedures for these operations by selecting suitable engineering controls and personal protective equipment;
- Ensure, in collaboration with EHS, that all new laboratory workers complete laboratory safety training before working unsupervised in the laboratory, and that all workers complete annual refresher training thereafter;
- Ensure that all laboratory workers receive instruction in safe work practices, proper use of personal protective equipment, and emergency procedures;
- Ensure that all laboratory workers are familiar with the CHP and where it can be found;
- Provide access to safety information and specific training to laboratory workers for the hazardous chemicals with which they work (which may include training when the employee's exposure changes or when new workers start in the laboratory);
- Ensure that the CHP is supplemented with standard operating procedures applicable to the hazardous chemicals or operations used in the laboratory, as necessary;
- Provide all appropriate and required personal protective equipment to laboratory workers and ensure that they use the protective equipment necessary for the safe performance of their jobs;
- Assist the CHO and/or EHS personnel in fulfillment of their duties with respect to his or her laboratory;
- Correct deficiencies identified during inspections, as appropriate;
- Report all accidents or near-accidents that occur in his or her laboratory and take corrective measures so that they will not recur;
- Oversee proper disposal of all laboratory waste including hazardous waste, biological waste, and sharps waste from his or her laboratory.

3.6 Laboratory Workers

Individuals who work in or frequently visit laboratories where hazardous chemicals are used and/or stored are responsible for performing their work in accordance with the CHP. Responsibilities of laboratory workers include the following actions:

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- Adhere to all University, federal, state, and local health and safety standards, rules and regulations as they apply to the laboratory;
- Report all hazardous conditions to their PI, the CHO, EHS, and/or the LSC, as necessary;
- Inform the PI of any substantive changes in protocol or the introduction of new chemicals to the laboratory;
- Wear and use prescribed personnel protective equipment;
- Report any suspected job-related injuries or illnesses to the immediate supervisor and Research Occupational Health Program (ROHP), and seek treatment immediately;
- Refrain from operating any equipment or instrumentation until after receiving proper instruction and authorization;
- Remain aware of the hazards of the chemicals in the laboratory;
- Request information and training when unsure how to handle a hazardous chemical or procedure.

4.0 LABORATORY SAFETY TRAINING

Section 15: Training of the BPHC Permit Application provides details of the BSL-4 employee training program. The following is a brief summary of the requirements pertaining to the Chemical Hygiene Plan.

All individuals who work in laboratories must be apprised of the hazards of chemicals present in their work area. This information must be provided before initial assignment and before new potential exposure situations. It is the co-responsibility of the PI and EHS to ensure that all laboratory workers have received this information and have been properly trained. Training records are maintained by EHS staff. Individuals may request their training records by contacting the Associate Director, Research Safety, NEIDL, or his or her designee.

The training program for all BSL-4 laboratory workers relating to hazardous chemicals is the same as for any other laboratory at Boston University. It consists of addressing general laboratory safety, hazard communication, chemical waste management, security requirements, and any protocol-specific training conducted by the PI or his or her designee. Consult the Boston University CHP for details on general laboratory training.

5.0 MEDICAL SERVICES AND SURVEILLANCE

Section 7: Disease Surveillance Plan, of the BPHC Permit Application provides details of the BSL-4 Medical Surveillance Program. The following is a brief summary of the requirements.

Section 7: NEIDL Disease Surveillance Plan includes an Initial Health Questionnaire (IHQ) for all laboratory workers. The Research Occupational Health Program reviews the questionnaire to

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determine the specific medical surveillance requirements that may be necessary, based on the potential risks to which the individual may be exposed.

6.0 EXPOSURE MONITORING

Employee exposure determination shall be done in accordance with paragraph (d) of 29 CFR 1910.1450, and as outlined in the [Boston University Chemical Hygiene Plan](#).

Any chemical that is proposed to be used in the containment facility will first be reviewed by EHS and assessed for safety and compatibility with the containment, personal protective equipment, lab equipment, and processes and procedures. The chemical safety data sheet is a part of the risk assessment and provides valuable information including appropriate storage, response to spills and accidental exposures. Based on the properties of the chemical, additional measure may be needed to ensure that the use of the chemical can be safely performed. These may include specific safety procedures, engineering controls and additional personal protective equipment. Exposure monitoring will be performed for situations that involve the use chemicals that could cause a potential exposure. As part of the overall employee monitoring program, the Research Occupational Health Program (ROHP) conducts clearances of all personnel that work in the BSL4 with hazardous materials including agents and chemicals.

Good laboratory practices, prudent use of laboratory engineering controls, such as Class III and Class II Biosafety Cabinets, and the types and quantities of the chemicals used within the BSL-4 laboratories will keep exposure levels well below a regulated substance's action level or Permissible Exposure Limit (PEL). Additionally, all individuals working in BSL-4 laboratories are required to wear a positive-pressure full-body suit with an external source of air supply. This protective clothing minimizes the potential for exposure to any chemicals used in the facility. As such, the potential for airborne exposure to a chemical above the PEL for an OSHA-regulated substance for which there are exposure monitoring or medical surveillance requirement, is not applicable in the BSL-4 laboratories.

EHS possesses the knowledge and equipment to evaluate suspected chemical exposures on request and to monitor them as needed. If EHS identifies a need for exposure monitoring, the employees will receive results of the monitoring within 15 working days after EHS receives the results.

EHS addresses potential exposures based on quantity of chemical in the area. At any time, a Boston University employee who believes that exposure levels for a substance exceed the action levels or, in the absence of an action level, the PEL, may initiate the monitoring process by contacting the Chemical Hygiene Officer or individual who is responsible for coordinating exposure-monitoring requests. Spill response actions are in accordance with Chemical Spill SOP.

7.0 EMERGENCY PROCEDURES AND RESPONSE

Section 8: Comprehensive Emergency Management Plan of the BPHC Permit Application provides details of the BSL-4 laboratory emergency response program. The following is a brief summary of the requirements.

In the event of any type of emergency in a laboratory environment, quick and decisive action is important. All individuals who work in laboratories are trained annually on appropriate general response procedures for various emergencies. In an emergency, the PI or the Laboratory Manager provides information specific to the laboratory, as appropriate. Additionally, an [Accident Report and Analysis Form](#) must be completed by the Laboratory Supervisors/PI within 24 hours of the incident.

7.1 University-wide Emergencies

Boston University has a response plan for large-scale emergencies that affect University-wide operation.

Important BU Emergency Phone Numbers	
Control Center (Fire, Medical Emergency, Health and Safety, and Facilities Emergencies)	617-414-6666
Environmental Health & Safety Department (EHS)	617-638-8830
Public Safety (Security)	617-414-4444
Research Occupational Health Program (ROHP) 24/7	617-414-7647

7.2 Medical Emergencies

In the event of a medical emergency, NEIDL staff will contact the Control Center at 617-414-6666 for emergency medical assistance. If properly trained to do so, they will administer first aid until help arrives.

7.3 Fire

The acronym RACE describes the steps and procedures for implementing the Fire Safety Plan for all buildings at Boston University. RACE is listed on red identification cards carried by some staff, and below.

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Rescue: Remove person(s) from the immediate fire scene/room.

Alert: Alert everyone in the laboratory to the fire by calling out “code red.” Call the Control Center at 617-414-6666 to report details and the exact location of the fire.

Confine: Confine fire and smoke by closing all doors to rooms in the laboratory.

Evacuate: Evacuate the building according to procedure.

Safety is paramount in the event of a fire. Individuals who work in laboratories are trained to secure all hazardous biological materials, return all animals to their cages, and turn off all equipment—if it is safe to do so. Evacuate through the nearest safe exit, using the normal exit procedure.

7.4 Chemical or Biological Spills

Spill kits are available in every laboratory suite. The procedure in the event of chemical or biological spills is to:

- a. Alert other occupants of the BSL-4 laboratory of the spill.
- b. Follow established procedures for decontaminating the spill.
- c. Contact the Control Center at 617-414-6666

7.5 Chemical Splashes to the Body

Persons working in a BSL-4 laboratory are required to wear positively pressurized full-body suits and are therefore fully encapsulated and protected from potential chemical spills. However, in the event that accidental contact should occur, the person must perform the following:

- a. Wash off and decontaminate the affected area of the personal protective suit while in the laboratory. Another laboratory occupant can provide assistance.
- b. If there is a breach of the suit with skin contamination, alert other occupants of the laboratory of the incident and exit the laboratory following standard protocols.
- c. Contact the Control Center for medical assistance at 617-414-6666, if required.
- d. Report the splash to the PI, Research Occupational Health, and EHS as a potential exposure (chemical, and—because the suit is breached—biological).

8.0 LABORATORY DESIGN AND ENGINEERING CONTROLS

Engineering controls and air-supplied suits are the primary means of minimizing exposure to hazardous chemicals within the BSL-4 laboratories. Engineering controls include: general laboratory ventilation and Class II and III Biosafety Cabinets used to minimize exposure.

EHS works closely with the PI of each laboratory to understand the nature of the materials and research, including the potential chemical hazards. Chemicals that will be used are reviewed to determine and ensure that they are compatible with the PPE used in the containment. This includes their compatibility to the gloves, suit materials and chemical resistance to HEPA filters. Chemicals that are known to damage HEPA filters will not be used and prohibited in the BSL-4.

9.0 STANDARD OPERATING PROCEDURES

Boston University has developed a program to provide the Laboratory Supervisor/PI with a set of rules comprising a “generic SOP,” which is applicable to the use of most chemicals under most circumstances.

The purpose of these standard operating procedures (SOPs) is to define the baseline set of procedures and practices for employees, students, visitors, and any other persons working in a laboratory at Boston University. These SOPs have been developed by EHS and/or the laboratory safety committee. Additional practices and procedures around safe work practices, as well as general chemical safety guidelines, are outlined in the [Boston University Chemical Hygiene Plan](#).

9.1 Purchasing Chemicals

The procurement process for purchasing hazardous chemicals for use in the BSL-4 laboratories involves collaboration between the PI and EHS. The PI is responsible for ordering laboratory chemicals. EHS advises the PI and researchers on safe practices that reduce risks, such as: purchasing and storing the minimum quantity of chemicals required for research purposes; replacing hazardous chemicals with less hazardous ones, when practical; and ordering chemicals in non-glass or protected glass containers when available. The use of glass containers or other glass products is not allowed in BSL-4 laboratories unless the use has been reviewed by EHS for risks and no other safer substitute is available. Glass materials can break and potentially puncture or cut a full-body positive-pressure suit and compromise its containment integrity. EHS will work with the PI to develop specific procedures for the safe use of glass containers and products in BSL-4 laboratories when there are no satisfactory alternatives for their use.

EHS also provides guidance for working safely, such as encouraging PIs to designate an expiration date to ensure chemical stability over the duration of the desired use period. The PI and researchers will consult with EHS before purchasing any chemical that has not been previously used in the laboratory.

EHS inspects all chemical containers upon arrival from vendors and does not accept any container without an adequate identifying label or any shipping container that is damaged or leaking. Laboratory workers date containers with the day, month, and year they are received. Materials that have potential to form organic peroxides are dated when first opened. This practice is recommended

for all other materials. These collaborative efforts ensure that the laboratory staff is knowledgeable of the hazards of the chemicals and the safe practices they should use.

9.2 Chemical Inventory

Controlling procurement, distribution, and storage of hazardous chemicals is an essential part of any Chemical Hygiene Program. The purpose of the chemical inventory is to maintain accurate and up-to-date chemical hazard information. The chemical inventories will include the types and maximum quantities of hazardous materials on hand at any time. Laboratory workers will monitor chemical use data annually and will record the amount of a chemical that remains in a container before preparing the container for waste pickup. The inventory will be maintained electronically using the chemical inventory module of the Research Information Management System (RIMS).

The inventory information is used for various purposes, which include:

- Providing PIs and EHS information for performing risk assessments to determine the need for additional safety precautions;
- Informing users of hazardous chemicals about the hazards of the chemicals they use or that are in their laboratories;
- Compiling a complete and accurate inventory of Safety Data Sheets;
- Providing emergency responders with information needed to respond to incidents with appropriate training and equipment.

The chemical inventories are updated annually and whenever a new chemical is introduced to a BSL-4 laboratory.

9.3 Safety Data Sheets

OSHA requires that Safety Data Sheets (SDSs) are available to employees for potentially harmful substances. An SDS summarizes information about the chemical, including: chemical components, hazard identification, first aid, spill response protocols, firefighting procedures, incompatibilities, safe handling and storage requirements, and disposal guidelines.

EHS NEIDL staff will obtain SDSs for all chemicals used in the NEIDL and maintain an up-to-date master file containing hard copy SDSs for all chemicals. The master file will be available at several locations for convenient use by all workers, including in the EHS office on the first floor of the NEIDL. EHS will also upload digital copies of the SDSs for rapid access at computer stations in the BSL-4 laboratories. This access will enable workers to review a chemical's SDS prior to working with the chemical and to gain immediate access to information for responding to spills, medical emergencies, and other situations involving the chemical.

9.4 Transporting Hazardous Chemicals within the NEIDL

The following apply whenever there is a need to transport hazardous chemicals within the NEIDL:

- Hazardous chemicals must be transported in plastic containers that can reasonably be expected to withstand moderate forces resulting from accidental dropping.
- Waste chemicals must be in primary containers that are compatible with the chemical, tightly closed and labelled before they are transported from the laboratory.
- If chemicals are transported on carts, weight and balance of the load should be checked for stability, and the primary chemical container placed in a secondary container, such as a leak-proof tray with sidewalls.
- Hand-carrying of chemicals in large bottles that could be accidentally dropped due to weight or carrying multiple bottles in corridors or in elevators is not permitted.
- If preparing a chemical for another user outside of the primary lab, the chemical must be labeled properly and an SDS provided to the additional user.

10.0 LABORATORY DOOR LABELING

The Boston Fire Department requires that all laboratories post the National Fire Protection Association (NFPA) 704 Diamond on its doors to communicate the hazards associated with the chemicals stored in the room. Most chemical labels also display the NFPA 704 diamond. The laboratory must inform EHS if the laboratory acquires different chemicals so that EHS can update the laboratory door sign.

11.0 PERSONAL PROTECTIVE EQUIPMENT

The approved personal protective clothing and equipment for laboratory workers in the BSL-4 laboratories is the full-body positive-pressure suit with an external air supply, and inner and outer pairs of gloves and boots. The approved personal protective clothing and equipment for laboratory workers in the BSL-4 cabinet-laboratory rooms include scrubs, disposable gloves, respirator, and dedicated rubber-soled shoes.

The use of chemicals in the containment facility shall be limited. Risk assessment and review of the chemical and its proposed use is conducted by EHS before it is allowed in the facility. This includes any proposed use of chemicals in the Class II B1 BSC. Chemical use in this BSC is limited to a small amount of diluted chemical solutions primarily used in conjunction with the biological and work with animal tissue and preservation. Chemical manipulation is performed in the directly exhausted area within the BSC.

12.0 LABORATORY SAFETY EQUIPMENT

BSL-4 laboratories will have different types of safety equipment, depending on the research that is being conducted. EHS will work with each laboratory PI and the Laboratory Manager during the experimental design process to develop the requirements for safety equipment, or to modify existing safety equipment used in the laboratory. A few of the more common pieces of laboratory safety equipment follow.

12.1 Chemical Showers

Laboratory workers in BSL-4 laboratories wear full-body positive-pressure suits at all times. The design of the suits provide for full-body protection against potential exposure to hazardous chemicals, including splashes into the eyes. The polyethylene material of the suit is resistant to chemicals that are in general use in the BSL-4 research protocols. Workers are prohibited from removing the suits prior to going through the exit chemical shower to decontaminate the surface areas of the suit from potential biological contamination.

12.2 Fire Extinguishers

The BSL-4 laboratory spaces are protected by a mist suppression system and a pre-action manually operated fire sprinkler system.

12.3 Chemical Spill Containment Kits

EHS provides Chemical Spill Containment Kits to common areas to provide laboratories with basic equipment to contain a chemical spill. EHS and the PI compile the kits and stock them with materials appropriate to the chemicals used in the laboratory.

13.0 SAFE WORK PRACTICES WITH PARTICULARLY HAZARDOUS SUBSTANCES

Section 17: Waste Disposal of the BPHC Permit Application includes details of the BSL-4 laboratory waste management program. The following is a brief summary of the requirements.

EHS, in conjunction with the LSC, has identified certain chemicals as high hazard chemicals. A chemical is considered “high hazard” if it has any health, physical, or environmental hazards that require additional safety and/or environmental practices beyond those of a typical laboratory setting, as required by existing regulations or upon review of the hazards by EHS, relevant oversight committees, or other institutional entity. Details on the [High Hazard Chemical Program](http://www.bu.edu/orc/files/2013/06/EHS-High-Hazard-Chemical-Program.pdf) (<http://www.bu.edu/orc/files/2013/06/EHS-High-Hazard-Chemical-Program.pdf>) are available online.

14.0 LABORATORY WASTE MANAGEMENT

The volumes of chemical waste generated from the BSL-4 laboratories will be low, not including that from chemical showers, due to the nature of research in the laboratories and the generally low volumes of chemicals the research procedures will use. All new chemicals are reviewed for compatibilities within the space, PPE and equipment prior to the introduction into the BSL4. Proper disposal of the chemical is determined before it is allowed to be brought in and used inside the containment facility.

Waste management requires proper segregation, storage, decontamination of all waste generated within the BSL-4 laboratories before the waste is removed from the laboratory (*Chemical Handling and Disposal in BSL-4 Suites SOP*). This requirement prevents any release of a biological agent outside of the laboratory as a contaminant of the waste material. Additional information on the treatment and management of solid, chemical and biological waste streams specific to BSL-4 can be found in Section 17: BSL-4 Waste Disposal and in the [BU Waste Management Plan](http://www.bu.edu/ehs/services/waste/) (<http://www.bu.edu/ehs/services/waste/>) for general laboratory spaces.

15.0 LABORATORY SAFETY INSPECTION PROGRAM

Section 10: Laboratory Inspections of the BPHC Permit Application provides details of the BSL-4 laboratory inspection program. The following is a brief summary of the requirements.

Laboratory inspections at the NEIDL employ three different methodologies:

1. Daily laboratory inspections, also known as the “Daily External Safety Checklist” inspection, performed by EHS to ensure that all critical systems are functioning correctly and that it is safe for BSL-4 and ABSL-4 workers to enter the space to conduct research activities;
2. Biannual inspections, which consist of a self-audit conducted by laboratorians and other users of the space;
3. Biannual laboratory inspections, comprehensive laboratory inspections addressing all aspects of safety and BSL-4/ABSL-4 facility compliance, conducted by EHS and the Quality Representative. Biannual inspections are conducted explicitly to assure compliance with federal, state, and municipal regulations as well as health and safety guidelines outlined in this plan and applicable manuals (e.g., the biosafety manual).

During the biannual laboratory inspection, the EHS and quality inspectors utilize a comprehensive checklist of items. The checklist helps identify areas for improvement within the laboratory. When deficiencies are identified, clear and concise instructions are provided in an inspection report, which is sent to the PI and laboratory safety representative. These instructions are intended to assist the

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laboratory in minimizing the hazards and achieving compliance, and also provide realistic timelines for their resolution.

The goal of the BSL-4 Laboratory Safety Inspection program is to make BSL-4 laboratories safe and compliant.

16.0 LABORATORY SECURITY

Section 12: Security of the BPHC Permit Application provides details on the BSL-4 laboratory security program. The following is a brief summary of the requirements.

Within the NEIDL, entry into each floor is restricted based on the specific work assignments of the individual. Once authorized, access is granted based on the work assignment at a location, the training, security clearance for unescorted access to select agents, etc., as appropriate. BPHC Permit Application Section 12: Security provides more information related to access control and authorization processes.

17.0 LABORATORY-SPECIFIC STANDARD OPERATING PROCEDURES

If required by the task, the PI, the Chemical Hygiene Officer, or EHS, laboratories may be responsible for developing their own SOPs beyond what is described in this CHP's SOPs. The process of developing laboratory-specific SOPs is intended to characterize various toxicological, regulatory, and physical criteria or to identify conditions that might require additional control measures, as well as to aid in the identification of those control measures.

It is the responsibility of the Laboratory Supervisor/PI to review all materials and substances being used. Upon such review, a determination and implementation of more stringent Site-Specific SOPs will need to be developed by the individual laboratory, as necessary. EHS will provide assistance in generating laboratory-specific SOPs.

18.0 CHEMICAL HYGIENE PLAN EVALUATION AND RECORD KEEPING

The CHP is reviewed annually and updated as needed by EHS and the LSC. Comments and suggestions on the improvement of this document should be directed to the Director, Office of Research Safety.

19.0 KEY REFERENCES AND RESOURCES

U.S. Department of Labor, OSHA Title 29 CFR - Part 1910.1450, "Occupational Exposures to Hazardous Chemicals in Laboratories"

U.S. Department of Labor, OSHA Title 29 CFR - Part 1910, Subpart Z, "Toxic and Hazardous Substances"

20.0 DEFINITIONS

Action Level: A concentration designated in Title 29 CFR - Part 1910 for a specific substance, calculated as an eight-hour time-weighted average, that initiates certain required activities such as exposure monitoring and medical surveillance.

Chemical Hygiene Officer: A qualified individual who provides technical guidance in developing and implementing a CHP.

Chemical Hygiene Plan (CHP): A written plan that establishes procedures and policies to protect laboratory personnel and other support staff from the potential adverse health effects associated with exposure to hazardous chemicals.

Hazardous Chemical: A substance that is recognized to have a measurable potential for adverse (acute or chronic) health effects in humans. The Hazard Communication Standard provides additional guidance in determining the extent of the hazard presented by a chemical.

Highly Toxic: A substance with a lethal dose (LD) or lethal concentration within the following limits: Oral: LD50 < 50 mg/kg (oral rat); Inhalation: LC50 < 200 ppm / 1 hr. or 2000 mg/m3 / 1 hr.; Skin Contact: LD50 < 200 mg/kg (rabbit).

Particularly Hazardous Substances: These include "select carcinogens," reproductive toxins, and substances that have a high degree of acute toxicity.

Permissible Exposure Limits (PELs): An exposure limit for OSHA regulated substances specified in Title 29 CFR - Part 1910.1000, Subpart Z, Toxic and Hazardous Substances.

Reproductive Toxins: Chemicals that affect an individual's reproductive ability including chromosomal damage (mutations) and/or have an adverse effect on a fetus (teratogenesis).

Select Carcinogen: A substance regulated by OSHA and designated by the National Toxicity Program (NTP) or the International Agency for Research on Cancer (IARC) as having a moderate-to-high potential for causing cancer in animal models. This designation separates moderate-to-high risk carcinogens from those with slight-to-minimal risk when viewed in the context of their use in a laboratory.

BU NATIONAL EMERGING INFECTIOUS DISEASES LABORATORIES

SECTION 3: BSL-4 Chemical Hygiene Plan

Appendix A

BSL-4 Typical Chemical Profile Used

The chemicals listed below are typical chemicals that will be used in the BSL-4 for research purposes and decontamination of spaces, equipment and materials. The chemicals will be limited to quantities that are only needed for research and specific work purpose.

Chlorine Dioxide

Ethanol

Isoflurane

Isopropanol

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SECTION 3: BSL-4 Chemical Hygiene Plan

Formalin

Trizol

PRL Degreaser

Paraformaldehyde

Process NPD Quat

Cage-Klenz 100

Cage-Klenz 200

CIP Neutralizer

Hydrogen Peroxide

Microchem